Marine Observatory at Kobe. Some of these combined, however, as they progressed eastward. Among the more important of these disturbances may be mentioned the following: The depression which traveled along the south coast of Japan on the 4th, eastern time; one which moved from the vicinity of Shanghai to the Okhotsk Sea, where it was central on the 18th; one which moved across the Japan Sea on the 20th, causing heavy gales, and disappeared east of the Kuril Islands on the 23d; one which passed over Japan on the 24th and moved northeastward across the Pacific. It is probable that still another depression quickly followed that of the 24th since the latter would scarcely account for the storm encountered on the 29th in longitude 167° E. by the Dutch S. S. *Arakan*, which will be referred to later.

The depressions on the Asiatic side during the first part of the month appear to have been directed either toward the Okhotsk Sea or the middle latitudes of the ocean. Those of the third decade traveled in the direction of the Aleutian Islands.

As a result of the cyclonic activity during the month many gales were experienced by vessels which furnish meteorological reports to the Weather Bureau. It is probable that the number of gales during the month was above the average, but a strict comparison is not possible with the data available. During the first week of the month they were chiefly reported from the region west of the 180th meridian, during the second and third weeks in mid-ocean, and in the last week west of the 170th meridian, W. longitude.

The following reports have been selected as representative of those received:

American S. S. *Pine Tree State* (since renamed *President Grant*), Capt. M. M. Jensey, Observer H. V. Van Dusen. While proceeding from Yokohama to Kobe the *Pine Tree State* was involved in the storm which passed along the south coast of Japan on the 4th, eastern time.

March 3, 33° 50′ N., 137° 10′ E., weather extremely sticky, inky clouds, very clear. Increasing easterly wind to strong gale, rough sea; barometer dropping fast but not far. March 4, 8:15 a. m. (L. M. T.), 33° 25′ N., 135° 30′ E., wind suddenly dropped to dead calm, very rough sea. Wind suddenly sprung up from north, whole gale. Visibility during this small typhoon very poor. Heavy rain at intervals.

Japanese S. S. *Mandasan Maru*, Capt. Tatsuzo Itoh, Yokohama for San Francisco.

Gale began on 4th, wind E., lowest barometer, 29.65 inches, occurred when in 39° 36.5 N., 147° 9.5 E., wind at time being ENE., force 9. Gale ended on 5th, wind NW.

American S. S. *West Jessup*, Capt. G. A. Whitehead, Observer C. Baker, Japan for Seattle. This vessel on the 12th was on the southern edge of a depression having its center over Sitka, Alaska, with a strong high-pressure area over the Aleutians and one of moderate strength northeast of the Hawaiian Islands.

Gale began on the 11th, wind W., lowest barometer, 29.83 inches, occurred at 6 p. m. of the 12th in 50° 10′ N., 145° 30′ W., wind at time NW. Highest force of wind 11, shifts W. to NW., gale ended 10 p. m. of 12th.

American S. S. *Bessemer City*, Capt. John Murphy, Observer R. B. Rogers, jr., Los Angeles for Yokohama. During the period from the 9th to the 16th, when between 174° 55′ W. and 155° E., this vessel experienced a succession of gales associated with the strong rise of pressure over the Aleutians. The highest force was recorded on the 16th, 11, WSW. The barometer at this time stood at about 28.93 inches, the vessel being in a depression in the rear of the anticyclone.

Dutch S. S. *Arakan*, Capt. Samuel Van Ronkel, Observer J. H. C. L. Baan, Manila for San Francisco. On the 29th the *Arakan* was involved in a deep depression, evidently the same one which appeared at Dutch Harbor on the 31st. Captain Van Ronkel has submitted a very complete report of this storm as observed on his vessel. The influence of the storm began to be felt on the 28th, when the *Arakan* was in 37° 52′ N., 160° 3′ E. The lowest barometer recorded was 28.47 inches at 5 a. m. of the 30th, the wind at the time being NW., 4. A remarkable feature of the storm, states Captain Van Ronkel was that neither the force of the wind nor its direction gave any indication as to the nearness or direction of the center. After the center had passed the wind freshened rapidly and by 11 a. m. was blowing with force 10–11 from WNW.

Date and hour.	Lat. N.	Long. E.	Bar.	Wind.	Weather.
	° ′	° ′			
Mar. 28:					
12 noon...	37 52	160 3	29.79	SW. by W., 4.	Overcast. Nb., 10.
4 p. m....	38 10	160 45	29.68	SW. by W., 5.	Sky var., clearing and overcast. Some rain.
8 p. m....	38 21	161 3	29.63	W., 5.....	Overcast. Nb., 10.
12 mid....	38 5	162 26	29.58	NNW., 2.....	Nb., 10. Great humidity.
Mar. 29:					
4 a. m....	38 49	163 9	29.58	NNE., 1.....	Nb., 10. Rain.
8 a. m....	39 3	163 52	29.46	ENE., 1.....	Continuous rain.....
12 noon...	39 5	164 33	29.21	E., 3.....	Nb., 10. Rain. Light SW. swell.
4 p. m....	39 27	165 13	28.92	SSE., 4.....	Same conditions.
8 p. m....	39 35	166 1	28.82	SW., 3.....	Rain until 10.30, afterward clearing and stars visible till close to horizon. Sheet lightning all around. Light southwesterly swell.
12 mid....	39 48	166 41	28.63	S., 2.....	Clear sky. Sheet lightning all around; lightning in NE. WNW. swell.
Mar. 30:					
4 a. m....	40 1	167 23	28.49	NW., 3.....	Clear till 6.30, then overcast. Some rain.
5 a. m....	.....	.....	28.47	NW., 4.....	Wind rising fast after 6 o'clock. Thick rain. Very low visibility.
8 a. m....	40 7	168 4	28.66	NNW., 8-9....	Gale. Sky overcast, heavy showers; squally after 11 o'clock. Visibility better.
12 noon...	40 13	168 16	29.00	WNW., 10-11.	Squally with hail and rain.

The report continues to noon of April 1, the gale gradually abating. It is interesting to note that during the storm Captain Van Ronkel was in radio communication with the steamships *City of Victoria*, *Canadian Winner*, and *Shabonee*. The first-named vessel reported a barometer reading of 28.14 inches between 2 and 6 p. m. on March 30 in 42° 7′ N., 172° 44′ E.

Pressure at Midway Island was above normal during the first decade and below normal thereafter. The highest pressure recorded was 30.24 inches on the 8th, the lowest 29.76 inches on the 29th. At Honolulu pressure was above normal during the first and third decade and below during the second. The departures were not pronounced. Conditions at Dutch Harbor have already been described.

NOTES ON WEATHER IN OTHER PARTS OF THE WORLD.

British Isles.—The general rainfall for March, expressed as a percentage of the average was: England and Wales, 103; Scotland, 76; Ireland, 72; British Isles, 86.

In London (Camden Square) the mean temperature for March was 41.8° F., or 0.3° F. below the average; the duration of rainfall, 42.2 hours, and the evaporation 0.96 inch.[1]

France.—Paris, March 9.—Nearly all France has suffered heavily from the unusually violent storm which began three days ago, causing heavy material damage

[1] Meteorological Magazine, April, 1922.

and considerable loss of life. It was particularly severe in the northern Departments, whence come reports of numbers of persons killed and injured. Telegraph and telephone lines were blown down, cutting communications generally. The storm off the coast stopped virtually all marine traffic * * *.—*Brooklyn Eagle, March 9, 1922.*

Paris, March 23.—On the second day of spring surface transportation in Paris was demoralized by a small blizzard worse than any seen during the winter, and all France is white with an unusual snow.—*Brooklyn Eagle, March 23, 1922.*

Switzerland.—Geneva, March 15.—Winter in the Swiss Alps has been so severe that scores of wild boars, wolves, and other animals have been driven to the towns and lowlands in search of food * * *.—*New York Evening Mail, March 15, 1922.*

Italy.—Venice, March 23.—A Central News dispatch from Venice says that a tidal wave late last night inundated the city, the water rising to a depth of more than 3 feet in some of the public squares.—*Washington Post, March 24, 1922.*

Genoa, March 25.—The tidal wave which the past few days has swept the Adriatic shores of Italy to-day shifted to the Mediterranean side and extended throughout the Italian Riviera. Many of the railroads and streets of Genoa were inundated, forcing traffic to deviate in order to reach the center of the city. Ships anchored at various places along the coast suffered damage.—*Associated Press.*

Arabia.—Aden.—It is stated in the *Times* on March 28 that unusually heavy rains have filled all but one of the historic reservoirs of Aden.[1]

Africa.—Tetuan, Morocco, March 24.—A severe snowstorm and intense cold has interrupted the movements of the Spanish troops in this vicinity. Communications with the outlying posts have been cut, as the hills surrounding the city are covered with a thick layer of snow.—*Washington Post, March 24, 1922.*

Lourenco, Portuguese East Africa, March 4.—Serious loss of life and damage to property was caused by a tornado which recently swept the seaport town of Chinde, in this territory, destroying the Government office and many other buildings and causing the sinking of numerous launches and other craft in the port * * *.—*Washington Star, March 5, 1922.*

Japan.—Tokio, March 1.—Tokio to-day was in the grip of a severe cold wave and snowstorm, according to dispatches * * *.—*United Press, March 1, 1922.*

Hawaii.—Honolulu, March 19.—Semitorrential rains which have visited the Hawaiian Islands during the past week caused much damage and marooned many tourists and sightseers * * *. Extremely rough weather accompanied the rain, interisland vessel captains reporting the hardest voyages in years.—*Washington Evening Star, March 19, 1922.*

Brazil.—There were destructive floods in the States of Rio de Janiero and Sao Paulo. * * * While in the northeast the cotton crop is suffering from lack of rain, the rice crop in the South is being damaged by abnormally heavy precipitation.[1]

[1] Meteorological Magazine, April, 1922.

DETAILS OF THE WEATHER IN THE UNITED STATES.

GENERAL CONDITIONS.

The outstanding feature of the month was perhaps the excess of rainfall as shown in detail on the inset of Chart V. Heavy rains in March are due to the course taken by cyclonic systems of wind circulation which cross the United States.

During the current month these systems moved from Texas northeastward, crossing the Mississippi in the vicinity of Cairo, Ill., moving thence up the Ohio Valley, and then passing almost directly eastward to the coast. By a movement such as described these storms cross successively the western tributaries of the Mississippi, south of the Missouri, and thus precipitate a large quantity of water in the several basins so crossed. Continuing up the Ohio Valley, the river of the same name must also reach flood stage. While the quantity of water contributed by the storms of the current month was not in itself sufficient to produce a large flood, it doubtless laid the foundation for the great flood which, at this writing (May 1), is passing down the lower Mississippi.

Another exceptional feature of the weather was the high mean pressure over the outlet through which pass the great majority of storms which traverse the United States, viz, New England and the St. Lawrence Valley. Reference to the inset of Chart II, shows the extent to which pressure was above the mean in that locality. This excess was due to the fact that more than the usual number of anticyclones passed over the region in question, which may be simply another way of expressing the belief that the flow of polar air equatorward, for some reason, followed the Hudson Bay-Halifax route.

East of the Rocky Mountains the month was warm and wet; to the westward it was cold and relatively dry.

The usual details follow.

CYCLONES AND ANTICYCLONES.

By W. P. DAY, Observer.

The month was unusually active, both HIGHS and LOW exceeding the normal. Most of the important storms began as secondary developments over the southern slope of the Rockies or in the Great Basin and moved east-northeast to pass off the north Atlantic coast. High-pressure areas were not so strong as during the preceding month and few important ones were charted south of Canada, but the total number charted was the same in each case.

LOWS.	Alberta.	North Pacific.	South Pacific.	Northern Rocky Mountain.	Colorado.	Texas.	East Gulf.	South Atlantic.	Central.	Total.
March, 1922	6.0	6.0	1.0	.....	7.0	.....	.....	3.0	1.0	24.0
Average number, 1892-1912, inclusive	3.6	2.1	1.1	0.3	1.9	1.3	0.4	0.3	0.7	11.8

HIGHS.	North Pacific.	South Pacific.	Alberta.	Plateau and Rocky Mountain region.	Hudson Bay.	Total.
March, 1922	5.0	3.0	5.0	.....	1.0	14.0
Average number, 1892-1912, inclusive	0.9	0.7	5.6	0.9	0.5	8.5

FREE-AIR CONDITIONS.

By W. R. GREGG, Meteorologist.

As indicated in Tables 1 and 2, free-air conditions at all six kite stations and at all altitudes were, for the month